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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Multi-satellite aerosol observations in the vicinity of clouds" *by* T. Várnai et al.

Anonymous Referee #3

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The authors analyze the contribution of aerosol particle size and number concentration changes, 3D effects, and the effect of the MODIS instrument point spread function (PSF) to increasing MODIS reflectances as a function of distance from clouds. They use MODIS and CALIOP data and show that real aerosol changes contribute 70 to 85% of the increase and 3D effect and instrument PSF account for the rest. The paper is short and well written. I have comments clarifying some issues. With this the revision including these clarifications, I suggest publishing the manuscript.

My concern and question are how the inconsistency of cloud detection by MODIS and CALIOP is handled. On page 5 line 20 to 22, the authors describe that the analysis uses MODIS cloud mask. As a consequence, there must be cases when CALIOP sees no cloud at all when MODIS has cloud contaminations. If this happens and backscat-

ter is averaged including these cases, increasing the CALIOP signal toward clouds is diluted. Is there any possibility that the difference between MODIS reflectance and CALIOP backscatter increase is due to this? If cloud contaminated MODIS pixels are excluded from the analysis, it has to be stated clearly because MODIS data users have no way to screen such pixels unless they co-locate CALIOP data. For that reason, the result of this study is cleanest possible estimate of the contribution of aerosol, 3D, and PSF effect. The error in the aerosol optical depth, for example, by cloud contaminations might be much larger than the 3D and PSF contributions described in this manuscript.

Other minor comments Page 2 line 9 to 11 The statement is misleading since a large part of direct radiative effect comes from dusts, which are present with no direct relation to clouds.

Page 3 line 13 Particle populations. I suggest using number concentration.

Page 7 line 18 Instrument effect. This effect is called several different ways, including instrument blurring, point spread function. I prefer a use of the point spread function.

Page 8 line 9 through 16 This section describes things are not included in the simulation. Please add things that are included in the simulation.

Page 9 line 8 and 9 and equation 1 This is a big assumption since aerosols are submicron particles, i.e. the size equivalent to the wavelength. It assumes that the relative change of backscatter is the same as relative change of the phase function of the angle between the sun and nadir view. It works for the overhead sun but is there any theoretical base for this assumption for other angles?

Page 10 line 20 I am a little bit bothered by the use of 2/3 here while percentages are used for others. Looking Figure 6c, the aerosol contribution is 70 to 85% to me. I suggest changing 2/3 to 70 to 85% including the abstract.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 32039, 2012.